REMARKS

For convenience in responding to the rejections in the Final Action, claim 1 of the application as amended in the response filed December 31, 2007, is set forth below:

> 1. A lithium secondary battery comprising a positive electrode which is capable of occluding and releasing lithium, a negative electrode which is capable of occluding and releasing lithium and comprising carbon as a negative electrode active material, a separator between the positive electrode and the negative electrode, and a nonaqueous electrolyte comprising a nonaqueous solvent and a wettability improving agent,
>
> wherein the nonaqueous solvent does not have substantial wettability to the separator,
>
> the wettability improving agent is dissolved in the nonaqueous solvent, improves wettability of the nonaqueous solvent to the separator, and has an oxidative decomposition potential in a range of 4.5 V to 6.2 V based on the potential of a lithium reference electrode, and
>
> the separator comprises polyethylene, the electrolyte comprises a mixture of ethylene carbonate and

γ-butyrolactone and the wettability improving agent is selected from the group consisting of 1,3-dioxolane (DOL), 4-methyl-1,3-dioxolane (4-MeDOL), N,N-dimethylformamide (DMF), N-methylpyrrolidone (NMP), methyl formate (MF) and dimethyl sulfoxide (DMSO).

Claim Rejections - 35 USC § 102/35 USC § 103

The Office has repeated the rejection of claims 1-4 and 9-12 under 35 U.S.C. 102/103(a) as anticipated by or, in the alternative, obvious over Yoshimura et al., U.S. Patent Application Publication No. 2002/0051910 ("Yoshimura") and the rejection of claims 5-8 and 13-16 under 35 U.S.C 103(a) as obvious over Yoshimura that were made in the Action dated August 30, 2007.

In the Action dated August 30, 2007, the Office identified Yoshimura as disclosing all of the limitations of the claims of the present application including the limitation that the separator comprises polyethylene. The Office cited paragraph [0046] of Yoshimura for the disclosure of a polyethylene separator. In the response filed December 31, 2007, applicants argued that Yoshimura does not disclose a polyethylene separator. Applicants explained that the separator of Yoshimura comprises repeating units of p-

phenylene combined with a group (A) and that the separator of comparative example 1.4, in which the group (A) combined with p-phenylene in the repeating units is an ethylene group, is not a polyethylene and does not comprise polyethylene.

In the present Action the Office has taken the position that the separator of comparative example 1.4 is a polyethylene because it is a polymer with an ethylene repeating group.

Applicants again respectfully submit that the separator of comparative example 1.4 of Yoshimura cannot properly be termed a "polyethylene". Polyethylene is a polymer in which ethylene monomers combine with each other to form a long chain of carbon atoms. Stated differently, polyethylene comprises repeating units of ethylene: (See, for example, the attached printout from the Polymer Science Learning Center). In comparative example 1.4 the repeating ethylene units are separated by a phenylene unit and, therefore, the polymer is not polyethylene.

Removal of the rejections based on Yoshimura is in order since the basic premise on which the rejections based on Yoshimura is based, i.e., that the separator of comparative example 1.4 of Yoshimura is a polyethylene separator, is not correct.

The Office has also made new rejections of claims 1-4 and 9-12 under 35 U.S.C. 102/103(a) as anticipated by or, in the alternative

obvious over Kim et al., U.S. Patent Application Publication No. 2003/0073005 ("Kim") and of claims 5-8 and 13-16 under 35 U.S.C 103(a) as obvious over Kim. Kim was cited in the Action of August 30, 2007, as teaching the use of dioxolane as a lithium protective solvent in a lithium battery in an amount of 0-30 vol %.

In the present Action the Office has identified Kim as disclosing a lithium secondary battery including each of the limitations of claims 1-4 and 9-12.

Kim does not support a case of anticipation of the claims of the present application under 35 U.S.C. § 102. Although each of the elements of the lithium secondary battery of claim 1 is listed in the broad generic description of the elements of the battery of Kim, such cataloging of elements does place a battery having the specific elements of the battery of the present invention in the hands of the public as required to support a case of anticipation under Section 102.

Kim also does not support a case of prima facie obviousness of the lithium secondary battery of claim 1 under 35 U.S.C. § 103(a) because the Office has not shown by proper reasoning that a person of ordinary skill in the art could reasonably predict the properties of the battery as recited in claim 1 from the general teachings of Kim.

Moreover, the battery of the present invention is characterized in that wettability of a separator is reduced by decomposition of an additive agent at a potential of a positive electrode at an occasion of an unusual voltage condition which occurs during overcharging. This phenomena occurs only 4.5 V or more of the positive electrode potential. However, the positive electrode potential of Kim's battery is less than 3 V since the battery includes a sulfur positive electrode. Therefore, there is no reason to combine a wettability agent having an oxidative decomposition potential in a range of 4.5 V to 6.2 V based on the potential of a lithium reference electrode with the other components of the battery of Kim.

The foregoing is believed to be a complete and proper response to the Office Action dated March 17, 2008, and is believed to place this application in condition for allowance. If, however, minor issues remain that can be resolved by means of a telephone interview, the Examiner is respectfully requested to contact the undersigned attorney at the telephone number indicated below.

In the event that this paper is not considered to be timely filed, applicants hereby petition for an appropriate extension of time. The fee for any such extension may be charged to our Deposit Account No. 111833.

In the event any additional fees are required, please also charge our Deposit Account No. 111833.

Respectfully submitted,

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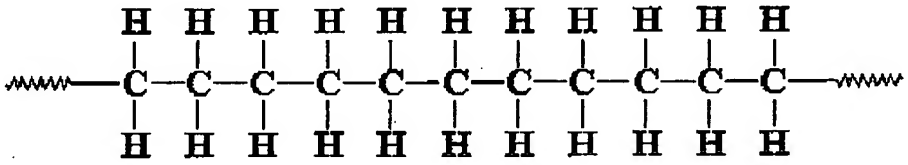
Polyethylene

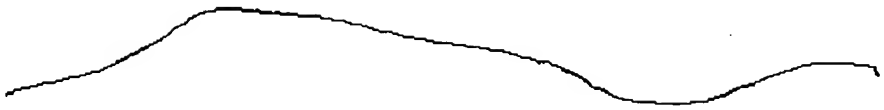
$$+CH_2-CH_2+_n$$

For polyethylene at a glance, click here!

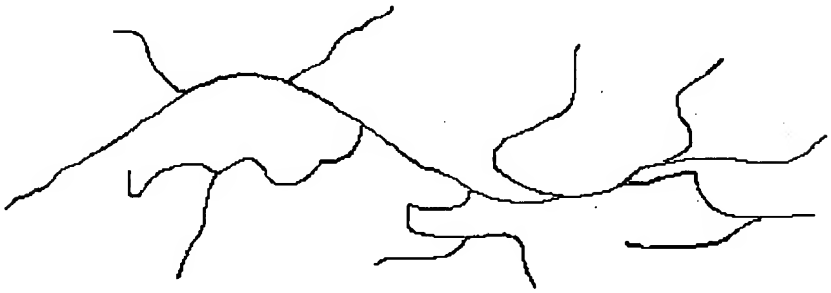
Polyethylene is probably the polymer you see most in daily life. Polyethylene is the most popular plastic in the world. This is the polymer that makes grocery bags, shampoo bottles, children's toys, and even bullet proof vests. For such a versatile material, it has a very simple structure, the simplest of all commercial polymers. A molecule of polyethylene is nothing more than a long chain of carbon atoms, with two hydrogen atoms attached to each carbon atom. That's what the picture at the top of the page shows, but it might be easier to draw it like the picture below, only with the chain of carbon atoms being many thousands of atoms long:



Sometimes it's a little more complicated. Sometimes some of the carbons, instead of having hydrogens attached to them, will have long chains of polyethylene attached to them. This is called branched, or low-density polyethylene, or LDPE. When there is no branching, it is called linear polyethylene, or HDPE. Linear polyethylene is much stronger than branched polyethylene, but branched polyethylene is cheaper and easier to make.

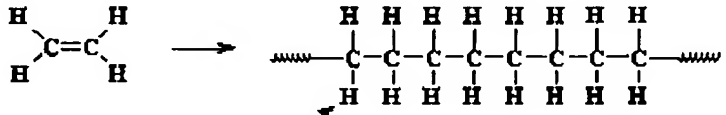


A molecule of linear polyethylene, or HDPE



A molecule of branched polyethylene, or LDPE

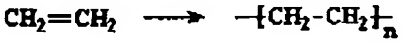
Linear polyethylene is normally produced with molecular weights in the range of 200,000 to 500,000, but it can be made even higher. Polyethylene with molecular weights of three to six million is referred to as ultra-high molecular weight polyethylene, or UHMWPE. UHMWPE can be used to make fibers which are so strong they replaced Kevlar for use in bullet proof vests. Large sheets of it can be used instead of ice for skating rinks.



This can get tedious to draw, so we often use shorthand like this.

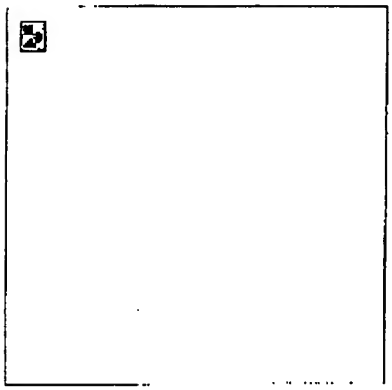
(Note: A line drawn between two atoms represents a pair of electrons shared by those atoms, which constitutes a chemical bond. Two lines represent two pairs of shared electrons, a double bond.)

And when we're feeling really lazy we just draw it like this:



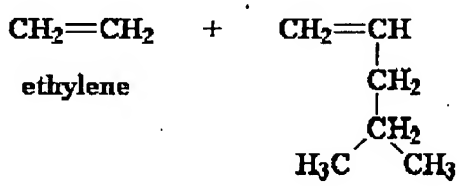
Polyethylene is vinyl polymer, made from the monomer ethylene. Here's a model of the ethylene monomer. It

looks like some sort of art nouveau teddy bear if you ask me.

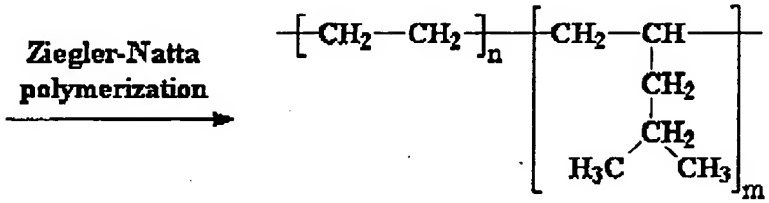


Branched polyethylene is often made by free radical vinyl polymerization. Linear polyethylene is made by a more complicated procedure called Ziegler-Natta polymerization. UHMWPE is made using metallocene catalysis polymerization.

But Ziegler-Natta polymerization can be used to make LDPE, too. By copolymerizing ethylene monomer with a alkyl-branched comonomer such as one gets a copolymer which has short hydrocarbon branches. Copolymers like this are called *linear low-density polyethylene*, or LLDPE. BP produces LLDPE using a comonomer with the catchy name 4-methyl-1-pentene, and sells it under the trade name Innovex™. LLDPE is often used to make things like plastic films.



4-methyl-1-pentene



poly(ethylene-*co*-4-methyl-1-pentene)
(BP's Innovex®, a form of LLDPE)

Other polymers used as plastics include:	Other polymers used as fibers include:
Polypropylene	Polypropylene
Polyesters	Polyesters
Polystyrene	Nylon
Polycarbonate	Kevlar and Nomex
PVC	Polyacrylonitrile
Nylon	Cellulose